SEASONALITY OF BIRTHS AMONG BEDOUIN ARABS RESIDING IN THE NEGEV DESERT OF ISRAEL

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Summary. From 1 January 1981 to 31 December 1982 information on all births to Bedouin Arab women residing in the Negev Desert of Israel showed a previously unreported seasonal pattern. The peak season, November–February, coincided with the period of cool temperatures and the Bedouin Arab cultural seasons of winter and spring. This pattern is different from those of Jewish and Christian groups in the same region, a difference not attributable to religion alone.

Sociodemographic factors associated with the peak season of birth include traditional occupations of fathers, multiparae 2+, and traditional place of residence. This pattern has persisted over the past 15 years although it is less apparent among the more recently sedentarized Bedouin Arabs.

Introduction

Seasonal patterns of births that have long been observed among human populations are influenced by both cultural and biological factors. In the United States, for instance, the peak in births occurs in September, 9 months after Christmas and New Year. In France, the peak in births is May, 9 months after the August Independence Day holiday. As part of a longitudinal study of infant feeding, morbidity and growth, information was collected on all births to Bedouin Arabs in the Negev Desert of Israel from 1 January 1981 to 31 December 1982, 2 years which coincided with planned social change.

The Bedouin Arabs living in the Negev, a semi-arid zone in southern Israel, are historically semi-nomadic, herding flocks of sheep and goats, and cultivating winter crops of wheat and barley. They are making a transition from this semi-nomadic life style to a sedentary one based on urban settlement. Pasture land has become very scarce owing to the increasing urbanization of the Negev. The majority of Bedouin Arab men are manual workers in factories and live with their families in sub-tribal groups in huts and houses. The Israeli Government has encouraged settlement by offering them subsidized building plots and mortgages on easy terms in planned

urban settlements. Semi-nomadism is a way of life practised by very few Negev Bedouin Arabs today.

The objectives of this paper are: (1) to describe the seasonal pattern of births over time among the Bedouin Arabs; (2) to compare the Bedouin seasonal birth pattern with the pattern of births among other ethnic groups in Israel; and (3) to examine sociodemographic and cultural factors with potential influence on the Bedouin birth pattern.

Methods

The Bedouin Infant Feeding Study was a collaborative effort of the National Institute of Child Health and Human Development, Bethesda, Maryland, USA, and the Ben Gurion University of the Negev, Beer Sheva, Israel. The study population included all live and stillbirths to Bedouin Arabs in the Negev from 1 January 1981 to 31 December 1982 ($n = 4701$).

Births were identified from birth certificates, tribal scribes and midwives, and the hospital delivery log. Over 95% of the births in 1981 and 1982 were in the hospital, and therefore information about perinatal conditions was available from the maternity record while demographic data were abstracted from the birth certificates. Second year medical students at the Ben Gurion University were trained to abstract medical and vital records.

According to Negev Bedouin cultural perceptions, there are four distinguishable seasons: winter (Shira, November–February), spring (Arabiea, March–April), summer (Sayf, May–August) and late summer (Gayter, September–October). In contrast, mean monthly temperatures in the Negev are more indicative of two seasons, notably a cool one from November to February and a hot one from March to October. Therefore, the Bedouin Arab winter and spring coincide with the meteorological cool season while the Bedouin Arab summer and late summer coincide with the hot season.

During the cool season, daily maximum temperatures average 19°C from November to February, with slight increases in March and April (Table 1). The mean daily maximum temperature in the hot season is approximately 32°C. Night time temperatures are considerably below day time, as is common in semi-arid zones. The mean daily minimum temperatures are 8°C and 17°C during the cool and hot seasons, respectively, although night time temperatures may go as low as 1°C. For analytic purposes, the weekly average number of births in the two seasons was calculated by dividing the seasonal totals of births by 26 weeks.

Table 1. Monthly mean of daily maximum temperature (°C) during 1981 and 1982 in Beer Sheva

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1981	15	16	21	27	31	33	33	34	32	30	21	21
1982	15	17	20	26	28	32	33	33	31	29	21	17

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31	29	21	17

In order to examine the relationship between social change and seasonality of births, an indicator of social change, place of residence, was identified based on more than 10 years of research among the Bedouin Arabs by the anthropologist (G.L.H.). Place of residence was categorized into three types: planned, established towns; unplanned, transitional towns; and traditional Bedouin semi-nomadic encampments. Planned towns have amenities provided by the Israeli Government, including water, electricity, roads, schools and health clinics. The primary type of housing is permanent, although huts and tents are also present. Unplanned transitional settlements are spontaneous clusters of tents, huts and houses located near a permanent water source and road. Traditional encampments are usually isolated family encampments of tents with some huts. Traditional encampments and unplanned settlements have no electricity, and water is collected from wells, cisterns or pipelines. Since place of residence is highly correlated with other indicators of sedentarization, specifically the type of housing (tent versus house), type of cooking appliance and father's occupation, the family's place of residence is examined in relation to season of birth.

Data analysis was divided into three phases. In phase one, the 1981 and 1982 births were compared with births from 1977–80 and 1983–86 in order to describe the seasonal pattern of births over time. Then sociodemographic factors including maternal age, parity and marital status, paternal occupation and education were examined in relation to the seasonality of births. Because information on the last menstrual period was not collected, a crude estimate of the date of conception was used, defined as date of birth minus 9 months, to describe the seasonal pattern of conceptions. Stillbirths, defined as any non-live births at 28 weeks or more gestation, were also examined for seasonal trends.

In phase two, the seasonal patterns of births among the Negev Bedouin Arabs were compared with birth data on Jewish, non-Bedouin Moslem and Christian populations living in the same and other regions of Israel (Peritz, 1987, personal communication).

In phase three, all variables significantly related to season of birth in the univariate analysis were examined in a multiple logistic regression with season of birth (cool versus hot) as the dependent variable, using the logist procedure of the BMDP statistical package (Dixon, 1985) with backward elimination of any variable based on a P-value of 0·15 to remove. The goodness of fit of the model was tested by the Hosmer chi-square, which evaluates how well the predicted and observed values of the model agreed.

Results

The total number of live births to Bedouin Arab women living in the Negev was 2264 in 1981 and 2359 in 1982. The mean number of live births per month was 189 and 197 in 1981 and 1982, respectively. The parental characteristics are given in Table 2. The mean maternal age was 27·7 years and the majority were multiparae with four or more live births; the mean paternal age was 34 years. The 28% of fathers who did not report a place of residence for the birth certificate is a reflection of how Bedouin Arabs living in traditional encampments and unplanned settlements have no conventional

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Table 2. Sociodemographic characteristics of the Bedouin Arabs with infants born in 1981 and 1982

Variable	%	No.	Variable	%	No.
Place of residence			Parity		
Established	26	1202	1	14	653
Traditional	26	1213	2–3	23	1056
Transitional	19	895	4–5	20	920
Don't know/refuse	28	1311	6+	40	1826
Gaza/West Bank	<1	2	Don't know	4	168
Father's education			Mother's education		
None	70	3213	None	90	4142
Any	25	1169	Any	5	208
Don't know	5	241	Don't know	6	273
Father's occupation			Mother's marital status		
Professional	3	155	Married: 1st wife	74	3416
White collar	4	190	2nd wife	20	928
Independent/service	7	308	Don't know/refuse	6	269
Lorry driver	19	865			
Hired industrial	31	1436			
Hired agriculture	13	581			
Independent farmer	8	374			
Unemployed	8	310			
Don't know/refuse	9	404			

address. The percentage of families with unknown residences among the 1981 birth cohort (49%) was significantly higher than among the 1982 cohort (11%) because the investigators recognized the problem in 1981 and instructed the clerks how to record place of residence in 1982. Also, all mothers were interviewed at birth in 1982, hence the reporting difference.

During 1981 and 1982, the peak in Bedouin births occurred in November–February, coinciding with the Bedouin perception of winter. The mean number of births levelled off during March, April and May, and significantly dropped in June–September (Table 3). Indeed, the peak and trough in birth months is consistent across all time intervals though in the most recent births there has been a shift in the peak birth period to October–January (Fig. 1).

The Bedouin pattern of births differed significantly from all other ethnic groups in the region (Fig. 2a,b). The Negev Jewish births peak in July–October with a trough in February–May. The difference in the distribution of Bedouin and Jewish births for 1977–80 was significant ($\chi^2 = 57$, $P = 0.0001$). Two ethnic groups, Christians and non-Bedouin Moslems, living in other parts of Israel have similar seasonal birth patterns with a peak during the summer months (Fig. 3). Moreover, the birth distribution of each ethnic group was significantly different from the Bedouin seasonal pattern of births during the same period of 1982–86 (for Christians $\chi^2 = 219$, $P = 0.0001$; for non-Bedouin Moslems $\chi^2 = 127$, $P = 0.0001$).

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Table 3. Seasonal distribution (%) of births, stillbirths and birth weight for Bedouin Arabs in the Negev Desert of Israel in 1981 and 1982

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Births												
1981	12	8	9	8	9	7	7	6	6	7	10	10
1982	10	10	8	8	8	8	7	8	7	8	8	10
Stillbirths												
No.	8	7	6	8	4	6	6	6	10	9	6	2
%	10	9	8	10	5	8	8	8	13	12	8	3
Birth weight*												
>2·5 kg	11	9	8	8	8	7	7	7	6	8	9	10
<2·5 kg	11	9	8	7	8	8	6	7	9	6	13	8

*$P = 0.0988$.

The number of conceptions reached a peak 4 months prior to the peak in temperature, and declined steadily throughout the hot season (Fig. 4). The stillbirth rate [stillbirths/(1000 live + stillbirths)] was 16 per 1000 (78/4701) with no clear seasonal pattern of stillbirths (Table 3). There was no significant variation in the seasonal pattern of births by birth weight (Table 3).

Among the sociodemographic factors that were examined in relation to season of birth, parity (categorized as one versus two or more live births) was significantly associated with birth season (Table 4; $\chi^2 = 5$, $P = 0.029$). Specifically, there were more births per week to multiparae in the cool season than in the hot (73 versus 53) while no difference appeared among primiparae.
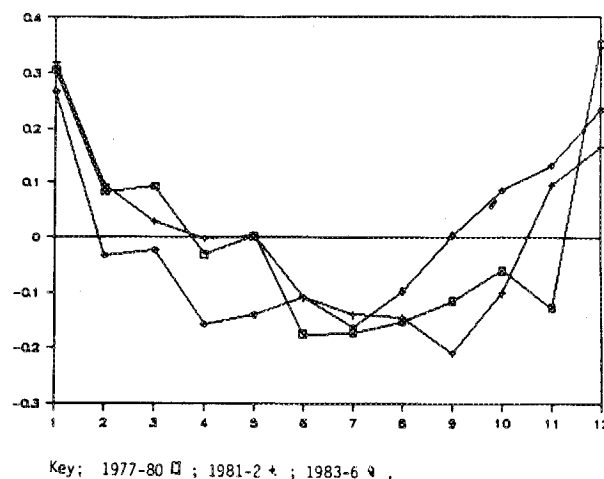

Key; 1977–80 ▫ ; 1981–2 + ; 1983–6 ◆ .

Fig. 1. Distribution of Bedouin births from 1977–80, 1981–82 and 1983–86, by month of the year.
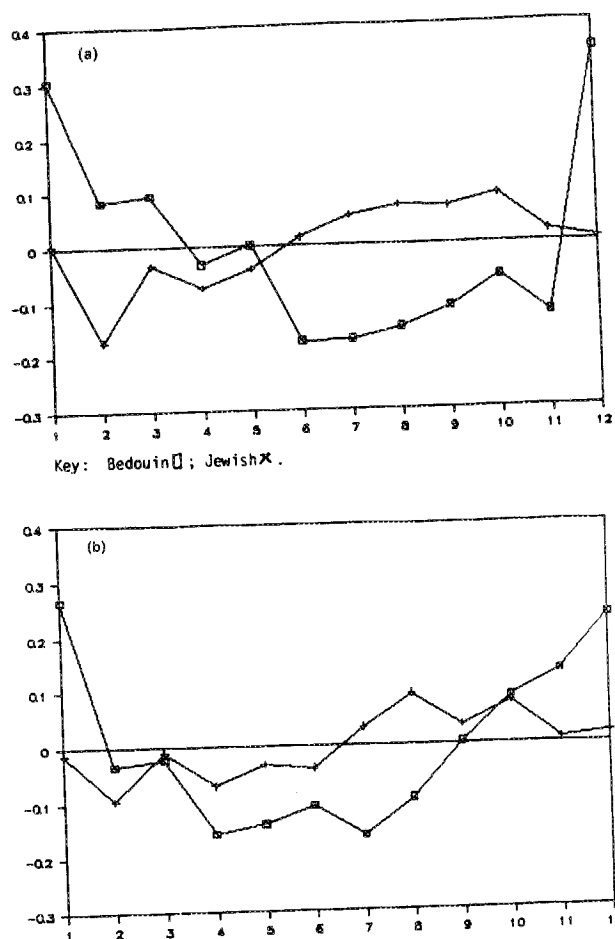
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Fig. 2. Distribution of Negev Bedouin and Jewish births: (a) 1977–80, (b) 1983–86.

Paternal factors associated with season of birth (Table 4) include father's education ($\chi^2 = 5$, $P = 0.043$), occupation ($\chi^2 = 82$, $P = 0.0001$) and place of residence ($\chi^2 = 43$, $P = 0.0001$). There were more births per week in the cool season to women with spouses who were not educated while women married to educated men showed no seasonal trend. Women with spouses working as hired agricultural workers had 50% fewer births per week in the hot season than the cool season. Women with spouses who were industrial workers or in other occupations (truck drivers, shop owners, professionals) showed a less dramatic seasonal decline in births per week from the cool to the hot season (18% and 7%, respectively). Finally, women with spouses who were unemployed had a 35% decline in weekly births from the cool to the hot season. Unemployment may be a seasonal phenomenon. For example, among fathers reporting no occupation at the time of his child's birth, 75% were employed and an additional 5% reported grazing flocks as their major occupation at the follow-up interview 6 months later.
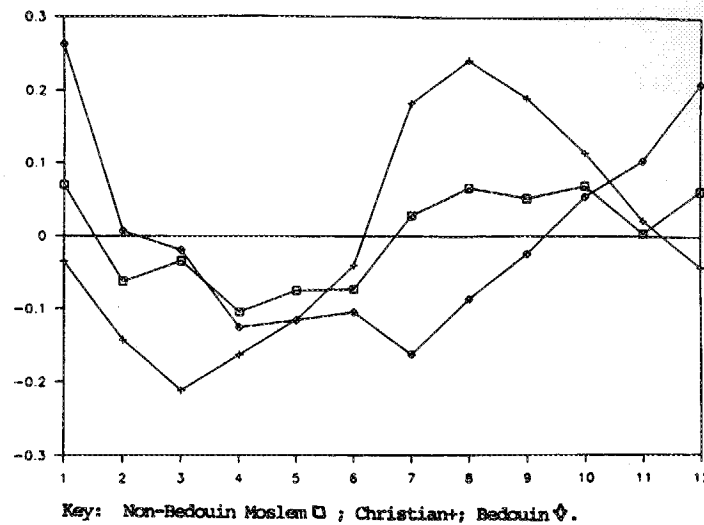
Key: Non-Bedouin Moslem □ ; Christian+; Bedouin ◊.

Fig. 3. Distribution of Bedouin, Christian and non-Bedouin Moslem births.

Families residing in the two more settled places of residence (unplanned transitional and planned established settlements) showed no clear seasonal birth pattern (Table 4); however, families living in traditional semi-nomadic settlements experienced a 28% decline in weekly births between the cool and the hot seasons. Likewise, a 38% decline in weekly births was seen in those who refused to report their place of residence. It is likely that a larger proportion of those who have no recorded place of residence were the more traditional Bedouins and held more traditional occupations. Univariate analysis of specific sociodemographic variables by place of
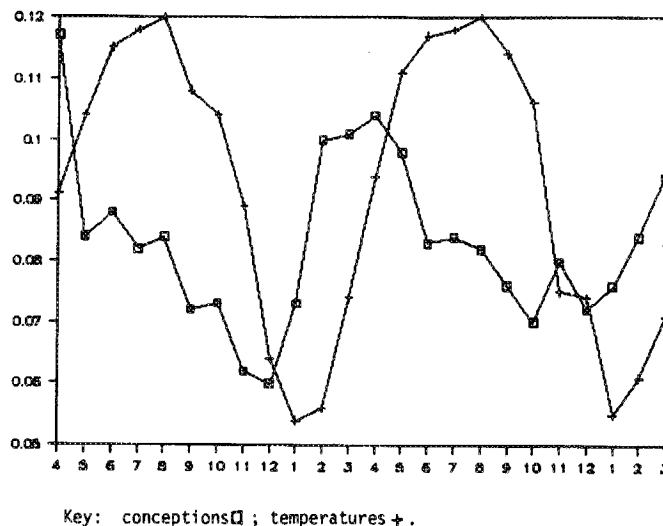

Key: conceptions□ ; temperatures + .

Fig. 4. Distribution of conceptions and maximum temperatures.

Table 4. Mean number of births per week by season among Bedouin Arabs living in the Negev

Variable	Wet season (November–April)	Dry season (May–October)	P
Parity			
1	11	10	0·029
2+	73	53	
Father's education			
None	70	54	0·04
Any	24	21	
Father's occupation			
Agriculture	15	7	0·0001
Industry	30	25	
Other	38	35	
Unemployed/don't know	17	11	
Place of residence			
Established	24	23	0·0001
Traditional	27	20	
Transitional	18	17	
Unknown	31	19	

Table 5. Multiple logistic regression models of season of birth excluding and including place of residence

Variable	Excludes residence (n = 4088) Odds ratio*	Includes residence (n = 4088) Odds ratio*
Occupation		
Other	1·00	1·00
Industry	1·18 (1·36–1·03)	1·16 (1·33–1·00)
Agriculture	2·00 (2·44–1·64)	1·87 (2·29–1·53)
Don't know/refused	1·58 (1·99–1·25)	1·48 (1·88–1·17)
Parity		
1	1·00	1·00
2+	1·41 (1·68–1·19)	1·41 (1·68–1·19)
Place of residence		
Established		1·00
Transitional		1·02 (1·22–0·85)
Traditional		1·30 (1·54–1·09)
Don't know/refused		1·55 (1·84–1·30)

*95% confidence interval in parentheses.

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1·87 (2·29–1·53)
1·48 (1·88–1·17)
1·00
1·41 (1·68–1·19)
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1·02 (1·22–0·85)
1·30 (1·54–1·09)
1·55 (1·84–1·30)

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residence demonstrated that the 'unknowns' most closely resemble the traditional semi-nomadic Bedouins (Table 4).

The results of the multiple logistic regression analysis were similar to the associations described by the univariate analysis (Table 5). The odds of being born in the cool season were greater if the child's father participated in traditional occupations (agriculture and shepherding) compared to modern occupations (industrial work and driving trucks). The chances of being born in the peak season increased with parity as well. Multiparae were 1·41 times as likely as primiparae to give birth in the cool season. Father's education was not significantly associated with season of his child's birth after adjustment for other covariates.

Because place of residence demonstrated such a significant association with season of birth in univariate analysis, it was included in a second logistic analysis. Given the large number of refusals, the 'refused' category was included in the variable place of residence for the regression analysis. This reduced the odds ratios for agricultural and 'not known' occupations but had little effect on the odds ratio of the industrial workers (Table 5). Thus place of residence may interact with the association between occupation and seasonality of birth. Including place of residence did not alter the parity effect. For those living in a traditional community the odds of birth in the cool season are 1·3 times those for residents in established settlements.

Discussion

During the last 15 years, the seasonal pattern of births among the Bedouin Arabs remained but the pattern is less apparent among the planned and unplanned settlements while it persists among the traditional groups. Bedouin births have traditionally and consistently reached a peak in the winter (December–February), levelled off during March, April and May, followed by a decline in June–October to begin increasing in November. If the pattern of births is regionally and, therefore, climatically determined, one would expect the same pattern among differing ethnic groups within the same geographical area. However, the seasonal patterns of birth for the various ethnic groups differ from those of the Bedouin.

It has long been acknowledged that seasonal patterns of births may be due to seasonal differences in climate at time of conception. High humidity and temperature in both animal (Ulberg & Sheean, 1973; Alliston, Howarth & Ulberg, 1965) and human (Appell & Evans, 1977) studies affect fertility. Temperature is more likely to affect the conception rate through changes in sexual activity. The optimal temperature for sexual activity (the 'comfort zone') is between 18°C and 21°C (Parkes, 1976). During the study period, the only monthly average of daily temperatures within this range was March (Table 1), exactly 9 months prior to the peak births in November and December.

Those Bedouins participating in the more traditional occupations (agriculture and shepherding) and living in the traditional tents and huts are exposed to the harsh desert climate to a greater extent that their more sedentary counterparts, on whose sexual activity climate may have less of an effect. The seasonal pattern of agricultural work may influence the pattern of conception as well.

Unfortunately, because the study was designed to examine infant feeding

Table 6. Seasonal distribution of births (%) among primiparae (aged ≤ 20 years)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
No.	21	26	25	28	22	29	32	38	27	29	40	28
%	6	8	7	8	6	8	9	11	8	8	12	8

practices and not seasonal patterns of birth, many of the factors which might have helped to elucidate the aetiology of the seasonality (e.g. date of conception, last menstrual period and frequency of intercourse) were not collected.

Many studies of the seasonality of births have noted seasonal trends in stillbirths as well. Becker, Chowdhury & Leridon (1986) reported that the peak in stillbirths in Matlab, Bangladesh, was in the hot, wet months (May–August) while the peak in births was in the cooler months (October–December). Similar results have been reported in Sweden (Sandahl, 1974) and India (Bernard *et al.*, 1978), with live births and stillbirths being negatively correlated. Among the Negev Bedouins, the peak in stillbirths corresponded to the lowest trough in live births (Fig. 4). However, due to small numbers which led to drastic monthly fluctuations, a true seasonal pattern of stillbirths could not be detected.

Cultural factors which may influence the seasonal pattern of births are dates of marriage, timing of breast-feeding, and of weaning practices. Marriages traditionally take place in the late summer. Given a 3–6 months wait time to conception in a population not using contraception (less than 5% of the women of childbearing age use contraception) and a 9 months pregnancy, first births among recent marrieds (≤ 20 years) should reach a peak in the subsequent summer or autumn (Table 6). By the second birth, the seasonal pattern appears, and is sustained by cultural breast-feeding practices. However, the question of how the transition from a non-seasonal pattern to a seasonal pattern occurs has yet to be answered.

It is culturally accepted that a child is weaned when he or she begins to walk, approximately 9–10 months of age (Hundt, 1985, unpublished). This is corroborated by the results from the Bedouin Infant Feeding Study (Forman *et al.*, 1990). Children in this population are exclusively breast-fed up to 6–7 months. However, intensive breast-feeding continues with mothers offering the breast up to twelve times a day until the child is 10–11 months old; a frequency that may prevent the return of ovulation (Huffman *et al.*, 1987). If a child is born in December and is breast-fed for 10 months, the earliest return of an ovulatory menstrual cycle might occur in October. Given that a sexually active woman not using contraception will have a 4–6 months wait time to conception followed by a 9 months pregnancy, the second child will be born between November and January, the peak birth season. This would lead to a birth interval of 24 months. Indeed, the reported mean birth interval among Bedouin women is 23–24 months.

With the rapid sedentarization occurring in the population, one would anticipate the Bedouin pattern of births to approach the pattern of other ethnic groups over time. This has not yet happened but is perhaps beginning, as suggested by the much weaker seasonal pattern noted in the Bedouin Arabs living in the transitional and established settlements.

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